

The Claims Defining the Invention are as Follows

1. An apparatus for exciting and detecting NQR in a substance containing quadrupole nuclei responsive to the NQR phenomenon, comprising:

a coil for irradiating an item that may contain a substance with RF waves to
5 excite NQR in quadrupole nuclei within the substance and for receiving an
NQR signal emitted in response thereto;

a transmitting means for producing and transmitting an RF pulse to the probe
to create said RF waves;

a receiving means to receive and treat a received signal from said probe for
10 subsequent processing and detection of a said NQR signal therein;

sensing means for sensing an extraneous parameter that may influence the
detection of the NQR signal from the item to be scanned; and

a computer for processing the treated received signal to identify a said NQR
signal therein, and control the transmitting means and the receiving means in
15 response to said processing means and said sensing means to optimise the
excitation and detection of the NQR signal.
2. An apparatus as claimed in claim 1, wherein said computer is adapted to
direct the transmitting means and the probe to irradiate the item at a range of
NQR frequencies that lie close to the NQR frequency of the substance
20 containing quadrupole nuclei to be detected, as adjusted in accordance with
the temperature measured by said temperature probe.
3. An apparatus as claimed in claim 1 or 2, wherein the sensing means is a
temperature probe for sensing the detected temperature is the ambient room
temperature.

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4. An apparatus as claimed in claim 1 or 2, wherein the detected temperature is the external building temperature.
5. An apparatus as claimed in claim 1 or 2, wherein the detected temperature is the scan item external temperature.
- 5 6. An apparatus as claimed in claim 1 or 2, wherein the detected temperature is the scan item internal temperature.
7. An apparatus as claimed in claim 1 or 2, wherein the detected temperature is some combination of the ambient room temperature, the external building temperature, the external item temperature & internal item temperature.
- 10 8. An apparatus as claimed in any one of the preceding claims, wherein a thermal image of the item is used to determine its temperature and detect excessively hot or cold scan items.
9. An apparatus as claimed in any one of the preceding claims, wherein the temperature detected originates from a probe ('tag') attached to the bag.
- 15 10. An apparatus as claimed in any one of the preceding claims, wherein an RF probe is used to monitor any RF emissions from the item to be scanned prior to it being scanned.
11. An apparatus as claimed in any one of the preceding claims, wherein sensors are used to determine the height and length of a scanned item prior to it being
20 scanned.
12. An apparatus as claimed in any one of the preceding claims, wherein said sensing means comprises a probe that is able to detect RF emissions from an item and send signals representative thereof to the NQR device, the NQR device having processing means to monitor the signals and if the RF
25 emissions from an item containing a sample exceed a prescribed threshold

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level, a signal is provided indicating that the item is not appropriate for NQR detection.

13. An apparatus as claimed in any one of the preceding claims, wherein said sensing means comprises an RF antenna that may be excited with pulses of RF energy to irradiate an item and receive return signals after a period of dead time, the NQR device having processing means to measure and transform the return signals into frequency space, and if the signal detected at the transmit frequency exceeds a predetermined threshold, signal the presence of a significant amount of metal.
14. An apparatus as claimed in any one of the preceding claims, wherein said sensing means comprises a plurality of RF antennas, one antenna being continuously excited with RF energy to irradiate an item to be scanned and the other antenna(s) being disposed to receive a signal in respect of the excited RF energy and null it out, thereby keeping the antenna in induction balance in the absence of any disturbance, and sensing such disturbance as may be caused by a metallic object to detect same.
15. An apparatus as claimed in any one of the preceding claims, wherein said sensing means comprises one or more metal imagers for creating an image of any metal objects detected within an item to be scanned.
16. An apparatus as claimed in claim 15, wherein said metal imagers comprise a multiple of coils arranged in a linear 1D, planar 2D or box shaped 3D array.
17. An apparatus as claimed in claim 16, wherein said metal imagers generate a metallic image by using long wavelength RF (1-100kHz).
18. An apparatus as claimed in claim 16, wherein said metal imagers generate a metallic image by using microwave energy (high MHz-GHz).

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19. An apparatus as claimed in any one of the preceding claims, wherein said apparatus is interconnected with an X-ray machine, whereby the X-ray machine is used to detect metal objects in the item to be scanned.
20. An apparatus as claimed in claim 19, wherein the X-ray machine provides 2D
5 or 3D X-ray images to identify metal objects.
21. An apparatus as claimed in claim 19 or 20, as dependent upon claim 18, wherein the X-ray image is combined with the microwave image to identify metallic objects not well identified by one or the other image.
22. An apparatus as claimed in any one of the preceding claims, wherein the
10 computer is adapted to monitor the resonant frequency and system Q as an item to be scanned is moved into the coil, and process Q profiles to identify the existence of metallic objects within the item.
23. An apparatus as claimed in any one of the preceding claims, wherein the
15 computer is adapted to change the operating frequency of the irradiating RF energy to detect certain metallic objects that are not easily detectable at low frequencies, and comparing measurements at these different operating frequencies to ascertain the presence of said certain metallic object.
24. An apparatus for exciting and detecting NQR in a substance containing
20 quadrupole nuclei responsive to the NQR phenomenon substantially as herein described with reference to the accompanying drawings as appropriate.
25. A method for exciting and detecting NQR in a substance containing quadrupole nuclei responsive to the NQR phenomenon substantially as herein described with reference to the accompanying drawings as appropriate.